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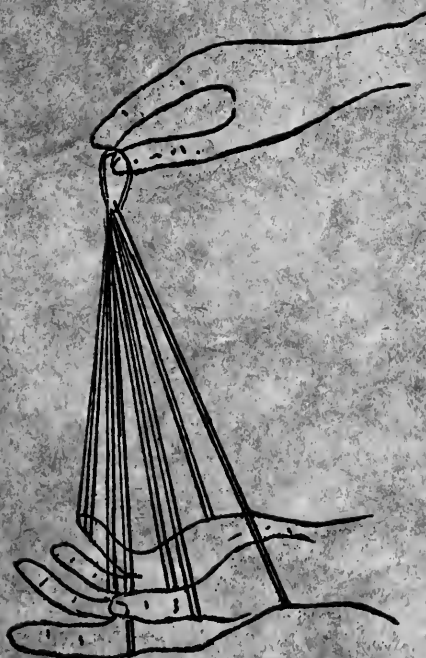
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AN INTRODUCTION TO STRING FIGURES

An Amusement for Everybody.

BY
W. W. ROUSE BALL.



CAMBRIDGE :
W. HEFFER & SONS LTD.

1920.

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TO
STRING FIGURES

BY
W. W. ROUSE BALL
FELLOW OF TRINITY COLLEGE, CAMBRIDGE.

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Prefatory Note.

THE making of String Figures is a game common among primitive people. Its study by men of science is a recent development, their researches have, however, already justified its description as a hobby, fascinating to most people and readily mastered. The following pages contain a lecture which I gave last spring, at the Royal Institution, London, on these figures and their history; to it I have appended full directions for the construction of several easy typical designs, arranged roughly in order of difficulty, and, for those who wish to go further, lists of additional patterns and references. The only expense necessary to anyone who takes up the pastime is the acquisition of a piece of good string some seven feet long; with that and this booklet to aid him, he will have at his command an amusement that may while away many a vacant hour.

W. W. ROUSE BALL.

Trinity College, Cambridge.

July, 1920.

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UNIVERSITY OF
CALIFORNIA

A Lecture on String Figures.

I HAVE chosen as the subject for this Lecture *String Figures*, which I present to you as a world-wide amusement of primitive man, and as being in themselves interesting to most people. In the course of the evening you will see how such figures are actually made, but before coming to that I must tell you something of their nature and history. I hope you will bear with me if I introduce them to you in my own way.

A string figure is usually made by weaving on the fingers a loop of string, about six-and-a-half or seven feet long, so as to produce a pleasing design, often supposed to suggest a familiar object, either at rest or in motion.

Having taken up the string in some defined way, the subsequent weaving may be effected either with the aid of another operator, each player in turn taking the string from the other, or by the single player making a series of movements, such as dropping a loop from one finger, transferring a loop from one finger to another, picking up a string with one finger and then returning the finger to its original position carrying the string with it, and so on ; unless I state the contrary it is to be assumed that it is with figures made in the second way that I am concerned to-night. In general, after each step, the hands are separated so as to make the string tight ; and normally the hands are held upright with the fingers pointing upwards and the palms approximately facing one another. [These movements were illustrated by the formation of one or two string figures.] Nothing more is required in most constructions, though many other small movements, notably slight rotations of the wrists, while not necessary, give neatness of manipulation and add to the effectiveness of the display.

These figures, when shown to a few spectators in a room, always prove, as far as my experience goes, interesting alike to young and old ; but their attractiveness, their fascination I might almost say, is not permanent unless people can be induced to construct them for themselves. I can hardly propose—and that is a difficulty inherent in lecturing on the subject

—I can hardly propose that for the first time, now and here, without individual help, you should make the designs you will see later. To enjoy the occupation, however, you must be able to make them, and, bold though I may seem, I venture to assert that if once you acquire this knowledge you will find pleasure in applying it.

It is a truism, and in fact a truth as well, that all sensible people have hobbies. I am not alone in finding that the collection of string figures is an agreeable hobby, and it may be added a very cheap one, while friends who have learnt the rules tell me that in convalescence and during tedious journeys the amusement has helped to while away many a long hour; moreover the figures are easy to weave, they have a history, and they are capable of many varieties. Thus even in England the game may prove well worth the time spent in learning to

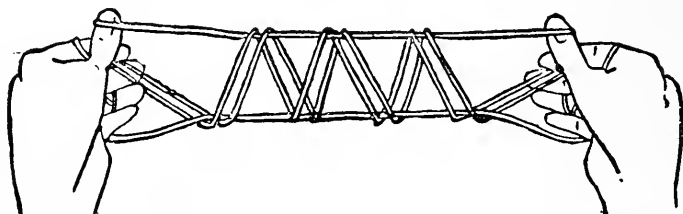


FIGURE 1—LIGHTNING.

play it; and admittedly to the very few who travel among aborigines it may sometimes be of real service.

It would be absurd to talk about string figures if you do not know what they are; so before I go any further let me show you what is meant by the term. These figures may be divided into three classes, α , β , γ , according as (α) the production of a design, or (β) the illustration of some action or story, or (γ) the creation of a surprise effect is the object desired; it will be desirable to begin by giving one or two examples of each class.

The designs reproduced in figures 1 and 2 are well-known forms which will serve as illustrations of figures in Class α . The first of them, a zig-zag pattern, termed *Lightning*, is due to the Navaho Indians who live on the Mexican border of Arizona, where the customs of the Red Man have not yet been wholly destroyed by civilization and law. [The figure as shown by the Lecturer was made by successive movements, as set out in the next paragraph.] The construction is simple,

and no digital skill is involved. You see the final result appears suddenly, almost dramatically, and I regard this as an excellent feature of it. Observe also that the production of the figure is rapid. Timing myself, I find I take well under ten seconds to make it. I think quickness, which comes easily as soon as one knows the moves, adds finish to the working and is worth cultivating.

The movements by which Lightning is produced are easy—a boy of eight or nine will learn them in three or four minutes—but as is the case with all these figures it is difficult to describe them concisely. To illustrate these statements let me express, as shortly as I can, exactly what I did. *First*, I put the string in the form of a figure of eight, one oval (preferably small) lying away from me, and the other towards me, and the strings crossing in the middle of the figure; I then put my index-fingers down into the far oval, and my thumbs down into the near oval; next I separated the hands and then turned them up into their normal position with the thumbs and fingers well spread out, thus causing the strings of the loops on the thumbs and index-fingers to cross one another. *Second*, I bent each thumb away from me over two strings, and with its back picked up from below the next string (i.e. in the language expounded later, the ulnar index string), and, as usually follows and is assumed to be the case unless the contrary is stated, returned the thumbs to their former positions. *Third*, I bent each mid-finger towards me over one string, and with its back picked up from below the next string. *Fourth*, I bent each ring-finger towards me over one string, and with its back picked up from below the next string. *Fifth*, I bent each little-finger towards me over one string, and with its back picked up from below the next string. *Sixth*, I moved my thumbs away from me, and placed their tips in the spaces by the little-fingers, their fronts resting on the near little-finger string; this released the thumb loops. *Lastly*, I threw the loops thus released over the other strings, and at the same time with the thumbs either lifted up the far little-finger string or pressed down the near little-finger string, and the figure flashed out. The description is lengthy, but in my opinion it is not desirable to labour at making this extremely concise.

The next diagram is of a design, known as a *Tent Flap* or *Door*, due to the Apache Red Indians. [The figure as shown

by the Lecturer was made as set out below on p. 25.] The Apaches are now almost extinct, but the figure is familiar to the Mexican Indians, who are said to have learnt it from Apaches living on the Reservation Lands maintained by the United States Government. This also is a figure in Class α .

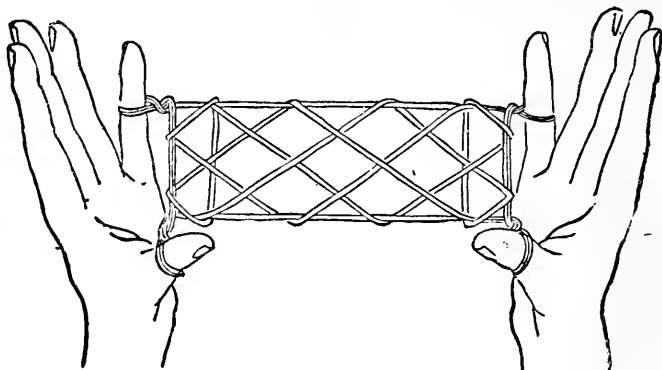


FIGURE 2—A TENT FLAP.

The two designs, represented in figures 3 and 4, will serve as examples of figures in Class β . The first of them is supposed to represent a *Man Climbing a Tree*, his arms and feet (or perhaps his tree-band and feet) clasping the tree trunk. It is derived from the Blacks in Queensland; since only a drawing of the

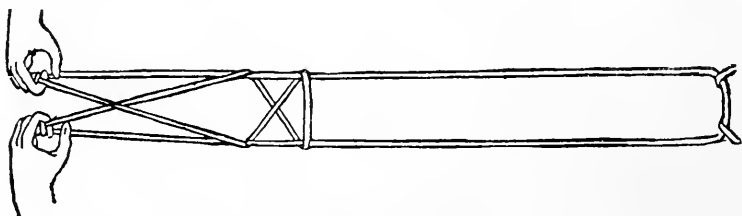


FIGURE 3—A MAN CLIMBING A TREE.

design was brought away, it is impossible to be certain how it was made by the aborigines, but the construction I am about to employ has been suggested, and is probably correct, since it is simple and involves no unusual actions. [The figure as shown by the Lecturer was made as set out on page 35.] In the figure thus obtained I pull with my index-fingers, and then the part which represents the man moves up the part which represents the tree trunk. Such motion is characteristic

of figures of this kind ; hence such results are often used as a framework for stories—two warriors fighting, a hammock breaking and its occupant falling out, and so on.

Closely allied to the production of moving figures, and almost indistinguishable from them, are String Illustrations of Stories. The well-known representation of the *Yam Theft* will serve as an example of this type of figure. [The construction as shown by the Lecturer was made as set out below on page 33, the final form being shown in the accompanying diagram.] You can tell the story much as you like. In one version of it the thumb loop represents the owner of a yam patch. He is supposed to be asleep. The loops successively taken up from the dorsal string and put on the fingers represent

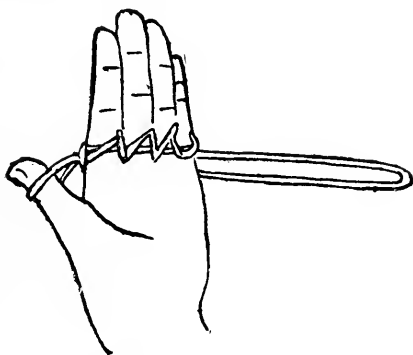


FIGURE 4—THE YAM THIEF.

the yams dug up by a thief, and tied up in bags ready for carrying off. The loop coming off the thumb represents the owner waking and going to see what is the matter. He looks down the dorsal side, sees the yams collected for removal, notices that the dorsal string holds them tight, and looks about for the thief. The thief, who may be represented by a loop on the pendant palmar string, coming back for his booty, sees the owner, whereupon (pulling the pendant palmar string) he disappears with all the yams. There is at least one British specimen of such a string story which deals with the misadventures of a thief who stole some tallow candles. I include these string illustrations of stories among the figures in Class β .

There is yet a third class, which I call Class γ , of string figures to which primitive man is very partial ; these are string paradoxes, where the unexpected happens. Take this as an

example. Here is a loop of string, held for convenience by my left hand high up. Obviously if I twist my right hand round one string of the loop and pull with the left hand, the right hand will be caught. If I give the right hand a twist round the other string of the loop, it is generally still more firmly caught. The problem is to give this additional twist so that the string runs free when the left hand is pulled. This can easily be effected by what is known in certain South Pacific Isles as the *Lizard Twist*. [This was shown and explained.] There is no trickery ; the movements are simple, yet I predict that few people, even if they have seen the twist, will succeed when they first attempt to make it. String paradoxes or puzzles of this kind are widely known, and are generally amusing. To show them, to be shown them, and above all to show pleasure in them, often lead to friendly intercourse with primitive folk, but they are different in kind from the figures about which I wish to talk. I put them, then, on one side as not relevant to my subject to-night, and come back to the formation as practised to-day of string designs in Classes *a* and *β*.

The study of string figures is new, and its history a short one. I may dispose of the story prior to 1902 very briefly. From about the middle of the nineteenth century onwards we find occasional notices by travellers in wild countries of the fact that the natives made, with a piece of string, forms different from and far more elaborate than the Cat's Cradle of our nurseries, but (with the exception of two examples described in France in 1888 and two in America in 1900) no details were given of how they were constructed, and in only a few cases near the end of the century were drawings kept of the patterns produced. There are more accounts of the Cat's Cradle familiar to children in England ; indeed they stretch back to the eighteenth century, for there is an allusion to it in English literature as long ago as 1768, and Charles Lamb refers to it as played at Christ's Hospital in his school-days. It is, however, a dull amusement, producing, as usually presented, merely four or five designs of little interest ; here, too, before the present century, no description was available which would enable anyone previously ignorant of the Cradle to make it. Outside Britain, in the nineteenth century it was known in Northern Europe, and travellers in Victorian times mention it as practised in Korea, China, and the Asiatic Isles.

We may say that before 1902 the whole matter of string figures was regarded as a pastime of children and savages, hardly worth mention and not worth consideration. To-day, when serious attention is given to folk-lore and the histories of games, such things are looked at from a different stand-point. The study of string figures came about in this way. In 1898 Haddon organised an anthropological expedition to the Torres Straits, and among other things brought back information about string patterns there current, together with some thirty examples. Some of these designs were made to the chanting of sing-songs, some were connected with tribal stories, and some were constructed as amusements, but everything suggested that here was a custom worth investigation.

This conclusion showed the need of having an unambiguous nomenclature which would allow anyone acquainted with it to describe a string figure in such a way as to permit of its reproduction by an intelligent reader. The terms introduced are taken from anatomy, and there is nothing recondite about them, but it is necessary to know them if you want to understand recent writers on the subject. Here they are :—

The part of a string which lies across the palm of the hand is described as *palmar*, the part lying across the back of the hand as *dorsal*.

Anything on the thumb side of the hand is called *radial*, anything on the little-finger side is called *ulnar*. Since a string passing round a finger or fingers forms a loop, each such loop is composed of a radial string, and an ulnar string.

Of two strings or loops on the same finger, the one nearer the palm of the hand is called *proximal*, and the one nearer the finger tip is called *distal*.

These six adjectives, palmar and dorsal, radial and ulnar, proximal and distal, together with the names of the parts of the hands, fingers, wrists, etc., enable us to state exactly the relative place of every string in a figure held on the hands.

This nomenclature is framed so as to define the position of strings on a hand by reference to the hand, and not by terms like near and far, lower and upper, which may mean quite different things according as to how it is held. At the same time, if the hands are held upright, and with the palms facing each other, which I regard as their normal position, we may conveniently use *near* and *far* instead of radial and ulnar, and

lower and *upper* instead of proximal and distal. It is, however, well to make it a rule that this every-day language is used only when the hands are in their normal position or when there can be no doubt as to the meaning; when there is no ambiguity I prefer to employ these ordinary words rather than the technical terms.

Precision of language, which was necessary if the subject was to be treated scientifically, was introduced only in 1902. Subsequent research has strengthened the interest taken in string figures, and in anthropological expeditions to-day they are among the matters on which information is sought. In particular Haddon has continued to stimulate enquiry, and to him we owe many of the patterns discovered. It is not too much to say that he is the creator of the science, and to his enthusiasm and knowledge many owe their introduction to it.

The Americans took up the investigation warmly, and in Philadelphia a valuable collection of drawings of string figures has been formed which will permanently preserve the patterns discovered. The results of the earlier work in America are embodied in a handsome volume* published in New York in 1906, containing full descriptions of about a hundred string figures, chiefly collected in North America and New Guinea, though with some examples from Africa, the Philippines, and other scattered localities. In it also are given drawings of more than another hundred finished patterns from Oceania and Queensland. Unfortunately Mrs. Jayne, to whose liberality and initiative the book was due, died shortly after its publication.

Further examples from places where the amusement was already known to exist, and collections from Africa and India, have since been issued, and show that the construction of string figures is widely practised where primitive man is still found. Examples also have been reported from South America, but as yet this immense area is an almost unworked field, the only well-known South American instance being a *Fly*—an example of Class β . [The figure as shown by the Lecturer was made as set out below on page 30.] The insect with its body and wings appears between the hands. Of course in such a position the natural thing is to try to squash it. To

* "String Figures," by C. F. Jayne, New York, 1906.

do this you clap your hands sharply together, then drawing them apart quickly and (if necessary) releasing at the same time the little-fingers, you will find that here, as usually happens in life, the fly will have disappeared.

In 1911 Miss Haddon* published in London an excellent popular account, with drawings, of some fifty of the results then known. Later, in 1914, Dr. Hambruch printed at Hamburg a long memoir on the subject, with special regard to the patterns found at Nauru in Micronesia, the home of some of the most skilful native exponents of the art, and then a German possession. Authorities for all the figures I am making to-night, except the Fly, will be found in Jayne or Haddon. Of course the outbreak of war in 1914 put a stop to researches of this kind, as of so many others.† Hence the serious study of the subject covers only twelve years—namely, from 1902 to 1914—and as yet few save specialists know much about it; but materials increase rapidly, and the number of recorded specimens, which in 1902 was less than fifty, already runs to many hundreds.

I may sum up the result of the work of these twelve years by saying that the evidence does not justify us in asserting dogmatically that all primitive people play and always have played at making string figures; but we may say that the game was at one time common among a large number of them. The formation of these designs is natural, for there are not many sedentary occupations open to uncivilized man during his long leisure hours, and to toy with a piece of string is an obvious recreation. What, however, is striking, is the immense variety of well-defined patterns already discovered, and their distribution in different parts of the world.

The search for and collection of designs was begun only just in time. With the advance of civilization, games such as these are apt to be discarded by adults, and survive only among the children. I suspect that this is why, until recently, when Cat's Cradle was imported from Asia, there were

* "Cat's Cradles From Many Lands," by K. Haddon, London, 1911.

† Post-war work on the subject has begun, and in particular I note R. H. Compton's interesting paper in the *Journal of the Royal Anthropological Institute*, vol. 49 (printed subsequently to the delivery of my Lecture), giving an account and the workings of 25 figures, including "The Caterpillar," "Sardines," or "The Ebbing Tide," and "The Porker," collected by him in Lifu and New Caledonia.

in European literature, covering many centuries of cultured life, no allusions to string figures.

Among existing aborigines, it is usually the women who teach the pastime to the children, and in most cases now-a-days the lads and men, though familiar with the methods used, do not of their own accord make designs in the presence of strangers. Hence the amusement may easily escape the attention of travellers; no doubt, also, many of these would take no interest in such figures even if they saw them. Moreover, in wild countries the natives are shy, and think that the white man will laugh at these simple games; thus an exhibition is not made unless encouraged by sympathetic advances, but if patterns are shown no secret is made about the method of construction, which is not treated as a tribal secret. To this open revelation of methods of weaving there is one reported exception mentioned by Boas, and referred to later. Even, however, when figures are displayed, it does not follow that it is easy to take down or follow the rapid sequence of moves made by the operator, so the collection of records may involve a good deal of gentle diplomacy.

I can give you an illustration of this reluctance to show figures unless they are asked for. A few years ago a traveller, near the Victoria Falls in Africa, met a high official of the Government, and, enquiring about various customs of the natives, asked if any string games were known in that part of the country. The officer said, "No"; he had never heard of them, he had lived for years among these people, had constantly seen them at work and at play, and was confident that nothing of the kind could exist without his knowledge. After their talk the visitor strolled to where the police escort waited, and taking out of his pocket a piece of string (without which to-day no self-respecting anthropologist ought to travel), made to their obvious pleasure a couple of string figures. He then tossed the string to a black orderly, who made other patterns. In fact these natives were acquainted with various forms, and when their questioner disguising his deeper knowledge, showed interest, they were delighted and readily exhibited to him such designs as they knew. One of these is worth reproducing here, for it represents (what is rare in such designs) a place, namely the Batoka Gorge on the Zambesi River below the Victoria Falls. [The figure as shown by the

Lecturer was made as set out below on page 24.] This incident suggests, what I believe is the truth, that the best way of

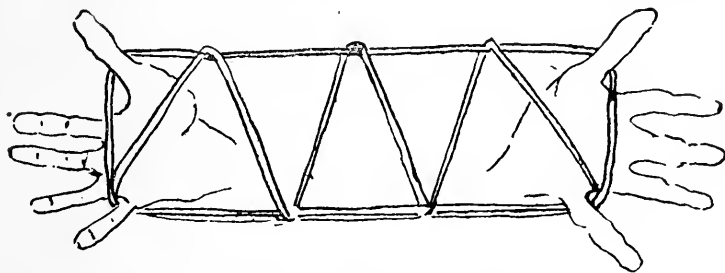


FIGURE 5—THE BATOKA GORGE.

finding out native figures is to make some oneself, and then challenge the natives to do better if they can; for this, no extensive acquaintance with their language is necessary, a very obvious advantage in opening communications on so technical a matter.

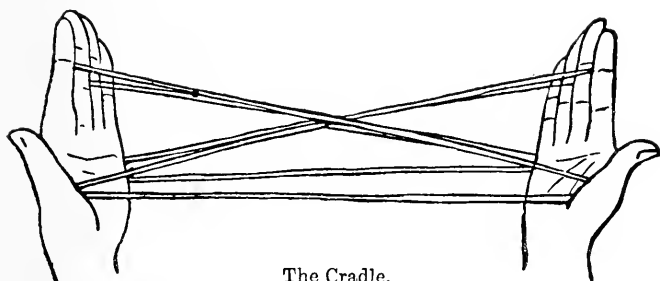
Apart from collectors, who naturally find pleasure in getting specimens of what they collect, travellers in uncivilized countries, even if uninterested in string figures, will find some knowledge of them a useful equipment. A native is apt to distrust a missionary, a prospector, and a trader; but a stranger, who exhibits what may well be taken to be one of the innocent games of his own people, offers credentials to which a friendly response is, as far as experience goes, invariably made. Who, indeed, would attribute evil intentions to one who comes armed only with a piece of string, and seems chiefly interested in amusements similar to those familiar to the onlookers in their childhood? This is not a matter of mere conjecture. I know of at least one definite instance where cordial relations were thus immediately established.

Of course from the beginning of the study of these figures the question arose of their possible relation to historical and religious traditions. Until now, however, with the exception of a few isolated facts, no evidence of such connection has been found. Indeed the only traces of it so far recorded are that in New Zealand the forms are associated with mythical heroes, and the invention of the game attributed to Maui, the first man; that various designs common to many of the Polynesians are often made to the accompaniment of ancient chants; that the Eskimo, too, have songs connected with particular patterns,

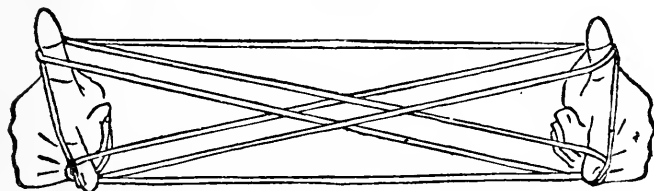
have a prejudice against boys playing the game for fear, it should lead to their getting entangled with harpoon lines, and hold that such figures, if made at all should be constructed in the autumn so as to entangle the sun in the string and delay the advent of the long winter night. Further, Boas asserts that among the Kwakiutl of Vancouver Island the form known as "Threading a Closed Loop" is used instead of a password by members of a certain secret society to recognise fellow-members. These facts, interesting though they be, do not come to much, and it would seem that as yet there is no substantial evidence that the construction of string figures is other than a recreation. I say "as yet," for new discoveries may at any time alter our views on this question.

Now let me put aside these historical questions, and consider the patterns actually made and their making. In opening the subject I remarked that for constructing string figures two methods are commonly applied; these are known respectively as the *Asiatic* and the *Oceanic*. In the former, two players are required, of whom one at each move takes the string from the other; in the latter, normally, only one player is required, who weaves the pattern with his fingers, using, if need be, his feet and teeth to assist him.

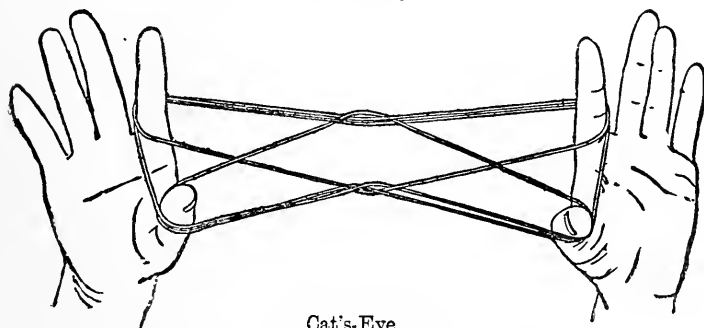
The Asiatic method lends itself to many varieties, but as far as I am aware these have not been developed, and broadly speaking this method is known to us almost only in the classical form, common in the English nursery, of Cat's Cradle. This form occurs in Korea, Japan, the Asiatic Islands, China, and Northern Europe, and the result is a figure of Class *a*. The weaving begins by the first player twisting the string round the four fingers of each hand, so as to make two dorsal strings and one palmar string; next picking up the string on the palm of each hand with the back of the mid-finger of the other hand, and then drawing the hands apart. In England, the four fundamental figures, which can be made in succession, are termed the Cradle, Snuffer-Trays, Cat's-eye, and Fish-in-a-Dish. These are shown in the accompanying diagram; the method of construction is widely known, and I need not display it here. Another figure, called a Pound of Candles, is usually (though unnecessarily) interpolated: a few other designs and an arrangement for a See-Sawing movement can also be introduced. That is all. In Korea the four fundamental figures are designated



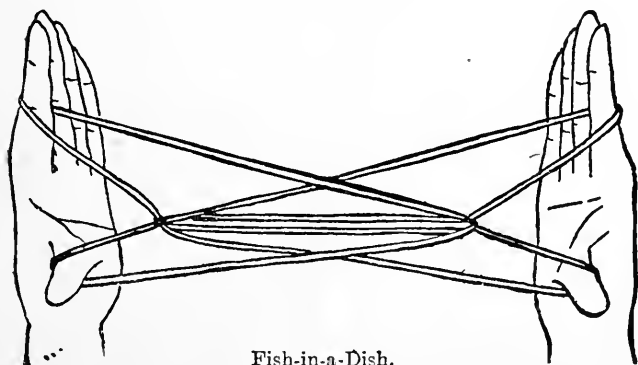
The Cradle.



Snuffer-Trays.



Cat's-Eye.



Fish-in-a-Dish.

FIGURE 6—CAT'S CRADLE: THE FOUR STANDARD FIGURES.

as a hearse-cover, a chess-board, a cow's-eye, a rice-pestle, and the interpolated figure as chop-sticks. In other places other names are given.

I do not propose to describe Cat's Cradle further. As usually played, it leads only to a fixed sequence of four or five forms; no skill is required, and there is little opportunity for variety. Probably to-day ethnologists are the only people of mature age who concern themselves with it. It is believed to have had its origin in Eastern Asia, and to have been thence conveyed to Northern Europe, perhaps by tea traders. A map of the localities in which it is practised shows a band of marks along the east and north of Asia and the north of Europe. From England, with its unceasing output of emigrants, missionaries, and venturers, it has probably been carried to other localities, but I do not think it is common outside the places I have named.

Oceanic examples of Classes α and β are more interesting and far more widely spread. They occur among the Eskimo, and the natives in America (North and South), Oceania, Australasia, Africa, and India, though the last-named country, as we might expect from its ancient civilization, has not given us many designs. In this form there is almost invariably only one player. The figures produced are numerous, and many of them can be made, and are made, in more than one way. In this country only one Oceanic construction, known as the *Leashing of Lochiel's Dogs*, has been discovered. [The figure as shown by the Lecturer was made as set out below on page 26.]

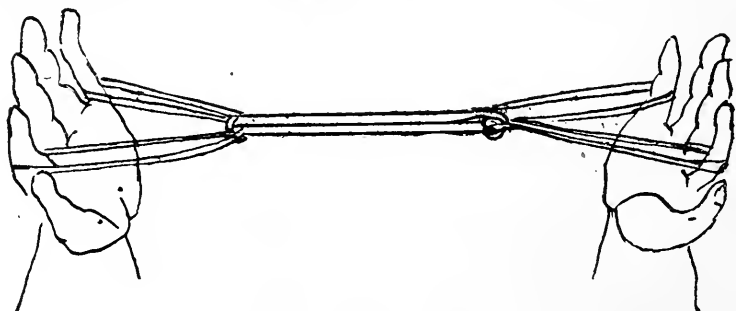


FIGURE 7—CROW'S FEET.

This, in some places termed *Crow's Feet*, is the most widely distributed of string designs as yet catalogued. It may be indigenous in Great Britain, but in a sea-surrounded land like

this, having ship communication with all parts of the world, it seems more likely that it is an importation.

Recently I came across an instance of how such figures may be introduced here. A friend of mine, then living at an inland town, showed me a well-known figure, sometimes called a *Fishing Net*, sometimes *Quadruple Diamonds*, which has been found in Africa, Oceania, and America, but was said to be unknown in Europe. [The figure as shown by the Lecturer was made as set out below on page 28.] This figure he had learnt here in boyhood, and therefore supposed it to be an English production. On enquiry we found that his nurse had taught it to him, and as a result of further talk it seemed that she had got it from a sailor to whom she had been engaged to be married; the conclusion that the latter had learnt it in the course of his

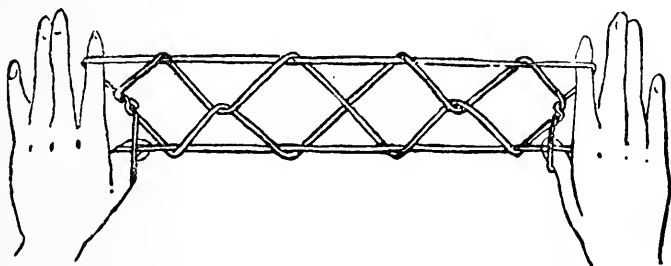


FIGURE 8—A FISHING NET, OR QUADRUPLE DIAMONDS.

voyages seems a safe one. The figure in question is typical of the numerous patterns made of diamond-shaped lozenges strung between two parallel strings, arranged either in single rows (of one or two or more, as the case may be) or in the form of rows side by side as in figure 2.

A remarkable feature in the Oceanic examples is that a large number of the figures begin in one way. In this the tips of the thumbs and little-fingers of each hand are put together, and then from below into the loop of string; next the digits are separated, and the hands drawn apart (this is called the First Position); and, lastly, the palmar loop on each hand is picked up by the back of the index-finger of the other hand: this is known as *Opening A* or *B*. The fact that such a normal (and not very obvious) opening exists all over the world suggests either that the game was played by the ancestors of the existing races before they were widely dispersed, or that in the long

series of past generations there has been more occasional intercourse between natives of distant localities than was formerly suspected, and of course a single stray voyager, whether travelling on his own initiative or driven from home by some unhappy chance, might serve to carry with him the methods of making such figures traditional among his own folk. Either view implies a long history, perhaps extending over thousands of years.

In *Opening A* the left palmar string is taken up before the right palmar string. If the right palmar string is taken up by the left-index finger before the left palmar string is taken up by the right-index finger we obtain *Opening B*. In most Oceanic figures it is immaterial whether we begin with *Opening A* or *Opening B*.

There is also another movement which is made in the construction of many figures. This is when we have on a finger two loops, one proximal and the other distal, and the proximal loop is pulled over the distal loop, then over the tip of the finger, and then dropped on the palmar side. This movement is not uncommon ; it was first discovered among the Navaho Indians : hence it is called *Navahoing the Loop*. I describe the process as *Movement T*.

And now having talked at large about the subject, I want to spend the remaining ten minutes in showing you a few of the more interesting and less common of these Oceanic figures. I had originally intended to make some myself, and use lantern slides of natives displaying others ; but I can do better, for Mrs. Rishbeth, who accompanied her father, Dr. Haddon, in one of his adventurous expeditions, and herself is among the ablest exponents of the art of making these figures, has kindly consented to come to London to show us various examples, most of which have never before been exhibited in public. [Mrs. Rishbeth then showed fourteen examples of string figures, six being in Class α and eight in Class β . Her drawings and the descriptions, in her own words, of her workings are given in an Appendix to the Lecture as published in the Proceedings of the Institution.]

In selecting these constructions as the subject of this Lecture I have been venturesome, but I plead guilty to liking to wander in the outlying fields of science, and, as I have found pleasure in String Figures and their history, I hoped that others might do the same.

Addendum.

String designs have little interest except to those who know how to make them. Cats-Cradling however is not a difficult operation, and to smooth the path of would-be learners I add these notes on figures I made in the Lecture, together with a few other typical ones: all here described are easy, and none of them should take more than twenty seconds to construct. I have selected these sixteen examples in equal numbers from the two standard classes, and placed those in each class roughly in order of difficulty; I advise the novice to mix his diet, and not to learn all those in one class before he begins to make those in the other.

The works by Jayne and Haddon, both excellent, mentioned in my Lecture, are more accessible than the articles in which the discoveries of these figures were first announced, and accordingly I refer, by choice, to these books (in which the sources of information are quoted) rather than to the original memoirs. Comparing the two authors, Jayne, like the present writer, avoids, as far as may be, technical words, while Haddon, following modern ethnologists, uses them freely; Jayne usually gives a diagram showing the positions of the hands and string after each step, while Haddon generally gives only the final arrangement of the string, not showing the hands.

* For the benefit of any reader who has mastered the constructions here presented and wishes to go further I have, at the end of each class, mentioned a few additional figures in it, and stated where descriptions of them can be found.

CLASS A. Of figures in Class *a*, I choose the following as being interesting and quite easy:—a *Fish Spear*, a *Frame-Work for a Hut*, the *Batoka Gorge*, a *Tent Flap*, *Crow's Feet*, *Lightning*, a *Butterfly*, and a *Fishing Net*.

I. A FISH SPEAR. (Class A). This is one of the simplest of String Figures, and its construction requires no skill. It is widely distributed, being found in New Guinea and the adjoining regions, and along the Western side of North America. The result is said to represent a three-pronged spear, the handle being held by the right index and the ends of the three prongs resting on the left hand. In British Columbia the figure is

known as *Pitching a Tent*, the six strings from the left-hand being taken to represent a frame work of six poles tied together at their tops.

It is made thus :—*First*, Take up the string in the form of the First Position. *Second*, With the back of the right index pick up, from below, the string which lies across the palm of the left hand, give it a couple of twists by rotating the right index, and return. *Third*, Pass the left index through the loop on the right index, then with its back pick up, from below, the string which lies across the palm of the right hand, and return. *Lastly*, Release the right thumb and little-finger, and extend, that is, draw the hands apart as far as practicable into their normal position. (See Jayne, p. 52 ; Haddon, p. 7.)

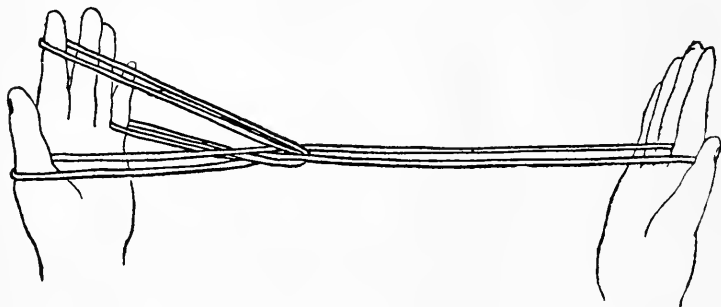


FIGURE 9—A FISH SPEAR.

The working may be summarised thus :—Opening A, except that the right index, after picking up the left palmar string, gives it two twists. Release right thumb and little-finger, and extend.

2. FRAME-WORK FOR A HUT. (Class A). This figure is supposed to represent eight poles tied together at their tops, forming a frame-work for a tent or hut. If the design is turned upside down it might well represent a *Parachute*. In the accompanying drawing the left hand is twisted back to enable the reader to see the positions of the loops.

In Central Africa, the Frame-Work for a Hut is made thus :—*First*, Holding the left hand horizontal, pointing to the right, and palm downwards place the string on it in the First Position, giving a long loop hanging down in front of the hand. *Second*, With the right thumb and index take up the string lying on the back of the left thumb, pull it over the back of that hand, and

let it hang in a short loop on the far side of the hand. *Third*, Pull the short loop through the long one, and loop it over the left index : draw tight, and raise the left hand into its normal position. *Fourth*, With the right thumb and index, pick up the string which is on the near side of the left little-finger, taking hold of it as close to the little-finger as possible, pull it out, and loop it over the left thumb. *Lastly*, With the right thumb and index take hold of that string on the back of the

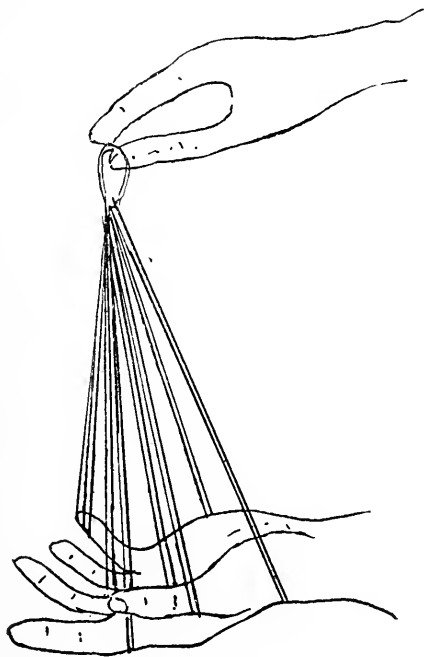


FIGURE 1C—FRAME WORK FOR A HUT.

hand which runs across the knuckles, pull it over the left fingers on to the front of the hand, and draw it away from the left hand : this movement can be assisted by working the left hand. (See Haddon, p. 29.)

Among the Red Indians a similar figure called a *Hogan* (for a drawing of it, see Jayne, p. 245) is made by a different process thus :—*First*, Put the left index and mid-finger through the loop, a short piece of string resting across the back of the hand and a long loop hanging down in front. *Second*, Put the right index, from the near side, under the near string between the left

index and mid-finger, over the cross string at the back of the hand, and with its tip pick up the cross string, and return; extend, and release the right index. *Third*, Put the right hand from the near side under the near hanging string into the pendant loop, and then with the right thumb and index take hold of the two strings between the left index and mid-finger, return through the pendant loop, and extend; release the right hand. *Fourth*, Bend the left thumb from you, and with its back pick up below the knot the near index string; bend the left little-finger towards you, and with its back pick up below the knot the far mid-finger string. *Lastly*, With the right thumb and index pick up that string on the left palm which goes across and over the two other strings on that palm; pull with the right hand, and the figure is formed. (See Jayne, p. 243, Haddon, p. 47.)

3. THE BATOKA GORGE. (Class A). I have in my Lecture mentioned and delineated this figure, and I have nothing to add to what I there said. It is interesting from the way in which it was discovered, and as being one of the few recorded attempts to represent geographical features by a string pattern. The construction is peculiar to the natives near the Victoria Falls in Africa. (See Lecture, p. 14; Haddon, p. 40.)

It is made thus:—*First*, Hold the right hand horizontal, pointing away from you and with its palm facing downwards; rest the string on the right wrist so that two equal loops hang freely down, one on its radial side, the other on its ulnar side. *Second*, Pass the left hand from left to right through both loops, and bring both hands into their normal positions. *Third*, Bend each little-finger towards you, and with its back pick up both the strings which cross each other in the centre of the figure. *Fourth*, Throw the near wrist string away from you over both hands to their far side. *Fifth*, Bend each thumb away from you, and with its back pick up the corresponding oblique near little-finger string. *Lastly*, Take each far wrist string and (keeping the other strings unaltered in position) pass it over the hand to the near side of the wrist. Extend the hands, and the figure, representing a bird's-eye view of the zig-zag course of the river through the gorge, will appear.

4. A TENT FLAP. (Class A). I have in my Lecture mentioned and delineated this figure, and I need not here repeat what is there set out. The design is familiar to most of

the Mexican Indians, who attribute its origin to the Apaches, a tribe now almost extinct. The result shows a pretty piece of string network which looks like a *Hurdle*, but is said to have been intended to represent the flap covering the opening to a tent ; it has alternative descriptive names, such as a *Poncho*, a *Sling*, a *Net*, and so on. (See Lecture, p. 8 ; Jayne, p. 12.)

There is a touch of romance in the story of its discovery. In September, 1904, Haddon, on his way to England, stopping one night at Philadelphia with Dr. Furness, expressed to Mrs. Jayne, the daughter of his host, his regret that he had no time to go to the St. Louis Exposition, where he understood he might meet some Mexican Indians whose tribal customs had not been investigated, and the talk drifted on to String Figures, a subject of which his fellow guests then knew nothing. The next morning Haddon sailed for Liverpool, and Mrs. Jayne, with characteristic American energy, went to St. Louis, found the Red Indians in question, and from them learnt, among other things, how to make the Tent Flap. That was the beginning of her interest in the subject, which in its early days owed much to her enterprise.

It is made thus :—*First*, Take up the string in the form of Opening A. *Second*, Lift the loops off the index-fingers, pass them over their corresponding hands on to the wrists, thus making them dorsal strings. *Third*, Bend each thumb away from you over one string, and with its back pick up from below the next string, and return. *Fourth*, Bend each little-finger towards you, and with its back pick up the next string. *Fifth*, Grasp with the left hand all the strings in the centre of the figure where they cross, pass this bunch of strings from the palmar side between the right thumb and index-finger so that the bunch lies along the arm, with the left thumb and index-finger take hold of the two loops on the right thumb, draw them over the tip of the right thumb, let the bunch of strings also slip over to the right thumb to the palmar side, and then replace the two loops on the right thumb : make a similar movement with the other hand. *Lastly*, Lift the wrist loops over the hands, letting them fall on the front or palmar sides of the hands, rub the hands together, separate them, and the figure will appear.

The working may be summarized thus :—Opening A. Index strings over the hands on to the wrists. Each thumb

over one and picks up one. Each little-finger picks up one. Thumb loops over groups of strings. Wrist loops over hands. Extend.

5. CROW'S FEET. (Class A). This figure, also, is mentioned and delineated in my Lecture, and I have nothing more to say about it. It is the most generally spread of string patterns at present known, occurring in Africa, Australasia, the Pacific Isles, America, and sporadically elsewhere. It may be native to Great Britain, where it is called the *Leashing of Lochiel's Dogs*, but it seems more likely that it was introduced here by sailors. It has many alternative names. (See Lecture, p. 18; Jayne, p. 116; Haddon, p. 73.)

It is made thus:—*First*, Take up the string in the form of Opening A. *Second*, Insert the four fingers of each hand from above into the corresponding thumb loops, and throw the near thumb string over the closed thumbs and fingers on to the backs of the hands. *Third*, Transfer each index-finger loop to the corresponding thumb. *Fourth*, Transfer each dorsal loop to one of the free digits of that hand, for choice I prefer the index-finger. *Fifth*, Pass each near little-finger string from below through the corresponding index-finger loop, place it on the far side of the little-finger, and Navaho the far little-finger strings. *Lastly*, Release the thumbs and extend. In the working of this figure in different places there are many small variations.

If the middle strings of the final figure are held by the teeth, the hands placed horizontally with their palms upmost, and the strings stretched, the result closely resembles the figure of *Two Hogans*, as made in Arizona, representing the poles of two small tents side by side.

6. LIGHTNING. (Class A). I have in my Lecture described and delineated this figure, and given its construction; I need not here repeat this. It was obtained from Red Indians who live on the border of Arizona, where ethnologists have been fortunate in finding natives able to describe old tribal customs and amusements; it has also been found in New Caledonia. It is an excellent example, but the last movement may present difficulty to a beginner. Of the two ways of making this final movement, both of which are given in the Lecture, I think the second (in which the near little-finger string is pressed down) is much the easier, but the diagram

I gave shows the result of lifting it up. (See Lecture, p. 6 ; Jayne, p. 216 ; Haddon, p. 51.)

The working may be summarized thus:—The Navaho Opening. Each thumb over two and picks up one. Each mid-finger over one and picks up one. Each ring-finger over one, and picks up one. Each little-finger over one, and picks up one. Release thumbs, put them into the spaces by the little-fingers, and rest them on the near little-finger string. Throw the loose hanging strings to the back of the figure, press down the thumbs, and turn the hands to face away from you.

7. A BUTTERFLY. (Class A). This, like Lightning, is a Navaho figure ; it represents the insect with its wings up. The working is more simple than the description suggests.

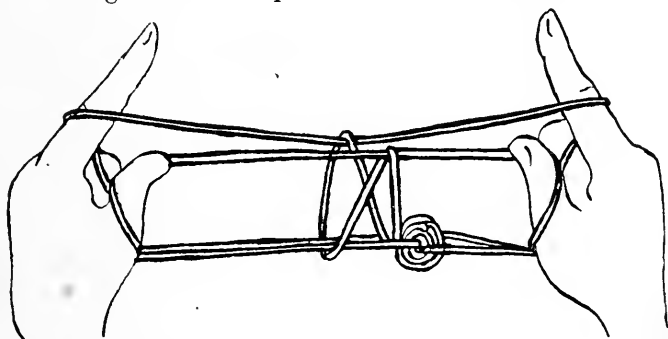


FIGURE 11—A BUTTERFLY.

The figure is made thus :—*First*, Take up the string in the Navaho way, that is make the first movement as when forming Lightning. *Second*, Twist each index loop by rotating the index-finger down toward you and up again four or five times. *Third*, Bend each thumb away from you over one string, with its back pick up the next string, and Navaho the thumb loops. *Fourth*, Put the tip of the index of one hand against the tip of the index of the other hand and similarly put the tips of the thumbs together ; then slip the right index loop on to the tip of the left index and the right thumb loop on to the tip of the left thumb, thus freeing the right hand. *Fifth*, Put the tips of the right index and thumb against the left thumb between the two strings on that hand, then slip the right index away from you under the loop on the tip of the left thumb, and slip the right thumb towards you under the loop at the base of the

left thumb. *Sixth*, With the right thumb and index lift both loops from the left index ; then put the left index away from you into the loop previously on the left index, and the left thumb towards you into the loop previously on the left thumb. *Lastly*, Draw the hands apart and when the strings have partially rolled up in the middle of the figure, use the free fingers of each hand to pull down the far index string and the near thumb string. The butterfly will now appear ; its wings being held up by the string extended between the widely separated thumbs and index-fingers. (See Jayne, p. 219.)

The working may be summarized thus :—Navaho Opening. Twist index loops. Each thumb over one and picks up one. Navaho the thumb loops. Take up figure afresh with thumbs and index-fingers, and extend.

8. A FISHING NET. (Class A). This figure is also mentioned and delineated in my Lecture. It has been found in Africa, Oregon, and the Hawaiian Isles. In some places it is called *Quadruple Diamonds*, in others a *Ladder*, and in others a *Fence*. (See Lecture, p. 19, Jayne, p. 24 ; Haddon, p. 36.)

It is made thus :—*First*, Take up the string in the form of Opening A. *Second*, Release the thumbs, then bend them away from you under four strings, and with their backs pick up the far little-finger string, and return. *Third*, Bend each thumb away from you over one string, and with its back pick up the next string. *Fourth*, Release the little-fingers, then bend each of them towards you over one string, and with its back pick up the next string. *Fifth*, Release the thumbs, then bend each of them away from you over two strings, and with its back pick up the next string. *Sixth*, Pick up from the base of each index-finger the near index string, and put it over the corresponding thumb, and Navaho the thumb loops. *Seventh*, Put each index-finger from above into the adjacent triangle, whose sides are formed by the radial little-finger string twisting round the two strings of the thumb loop. *Lastly*, Rotate the hands so as to face away from you (thus causing the little-finger loops and the lower index loops to fall off, the thumbs to point away from you, and the index-fingers to point upwards), and separate the hands.

The successive movements by which it is constructed may be summarized thus :—Opening A. Release thumbs. Each thumb under all the strings, and picks up the far string. Each

thumb over one, and picks up one. Release little-fingers. Each little-finger over one, and picks up one. Release thumbs. Each thumb over two and picks up one. Each near index string on tip of corresponding thumb. Navaho the loops on the thumbs. Index-fingers in triangles. Rotate the hands, releasing little-fingers, and extend.

A slight modification enables us to make the net with two instead of four meshes. To do this:—*First*, Take up the string in the form of Opening A. *Second*, Release the thumbs, then bend each of them away from you over three strings, and with its back pick up the next string. Then follow the sixth and two subsequent movements used in the construction of the Fishing Net. This working may be summarized thus:—Opening A. Release thumbs. Each thumb over three and picks up one. Each near index string on tip of corresponding thumb. Navaho the loops on thumbs. Index-fingers in triangles. Rotate the hands, releasing little-fingers, and extend. The effect is improved by using the string doubled, and thus reduced to half its length. (See Jayne, p. 28.)

Other ways of making two meshes of a net are given in Jayne, pp. 129, 228, 323. One mesh of a net can be made as shown in Jayne, pp. 64, 65, 391, 392. A way of making three meshes in line is given below in the seventh example of Class β . In the figure called *The Ebbing Tide* (see page 37) we get successively 2, 4, 6, 8, . . . meshes in line.

OTHER FIGURES IN CLASS A. Other excellent and easy figures in Class α are *Little Fishes*, from the Murray Islanders (see Jayne, p. 233; Haddon, p. 12), and *Carrying Wood*, from the Navaho Indians (see Jayne, p. 66; Haddon, p. 46). The well known *Cat's Cradle*, in which each player in turn takes the string from the other, also leads to figures in Class α : the workings for this are fully described in my "Mathematical Recreations," p. 360 *et seq.*, and Jayne, p. 324 *et seq.*

Of effective, but rather more difficult, examples I may mention five, namely, a *Rabbit*, from the Klamath Indians in Oregon (see Jayne, p. 79), a *Sea-Gull*, from the Eskimo (see Haddon, p. 57), a *Crab*, *Tree-Burial*, and a *Duck*. (For workings of the last three, see the Appendix to my Lecture as printed in the *Proceedings of the Royal Institution*.)

CLASS B. Of figures in Class β , I select the following eight as being easy and interesting :—the *Fly*, a *Siberian House*, the *Elusive Loop*, the *Yam Thief*, *Throwing a Spear*, a *Man Climbing a Tree*, a *Salmon-Net*, and the *Caterpillar*.

I. THE FLY. (Class B). This is the easiest of all the β constructions. I worked it in my Lecture in its South American form. Figures resembling it, and somewhat similarly made, have been found in many places, but the variety here given is perhaps the simplest and best of them.

It is made thus :—*First*, Put the thumbs, held upright, into the loop, and extend. *Second*, Move the left hand to a

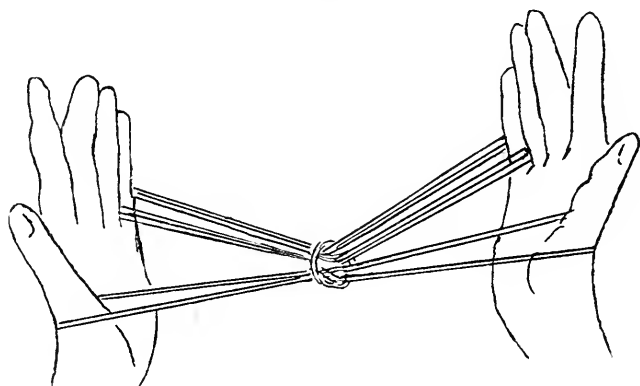


FIGURE 12—THE FLY.

horizontal position ; then turn it counter-clockwise under the strings and up towards you into its normal position, thus giving two dorsal strings. *Third*, Pass the right hand between you and the left hand, then put the right little-finger from above under the dorsal strings, pick them up, and return. *Fourth*, Pass the left hand between you and the right hand, then put the left little-finger on the palm, and pass it towards you under the two strings on the right thumb, pick them up, and return. *Lastly*, Lift the left dorsal strings over the digits, and extend. This is the Fly.

Next its proboscis (or some part of its anatomy) is shown by releasing the little-fingers. To try to catch the fly, clap your hands together : on drawing them apart quickly and as far as possible, it will always be found that the fly has escaped, in fact the display of the proboscis destroyed the figure.

(F. E. Lutz, "String Figures of the Patomana Indians on the Northern Brazilian Frontier," Anthropological Papers, Amer. Mus. of Nat. Hist., vol xii., New York, 1912.)

Ethnologists, more conservative than primitive men, deem it undesirable or worse to vary recorded methods, so with hesitation I add that the Indians might have made the conclusion more effective by not displaying the proboscis and thus not destroying the fly as a definite creation; in this case, as before, on trying to squash it, you clap your hands sharply together, then drawing them apart quickly and at the same time releasing the little-fingers, the fly will have disappeared. Of course with a fly or mosquito between one's hands the most natural thing is to try to squash it, but often, as here represented, without success.

The knot in the middle of the figure between the hands has also been taken to represent a coco-nut, and Compton reports that in Lifu the last movement is used to illustrate efforts to crush the shell. When clapping the hands the unskilful person, not releasing his little-fingers, fails, and on extending his hands it remains visible between them. But when the skilled native tries, then on clapping his hands and simultaneously releasing his little-fingers, he succeeds, and on extending his hands the nut is broken and gone.

2. A SIBERIAN HOUSE. (Class B). This was obtained from the Eskimo, who are experts in making string figures.

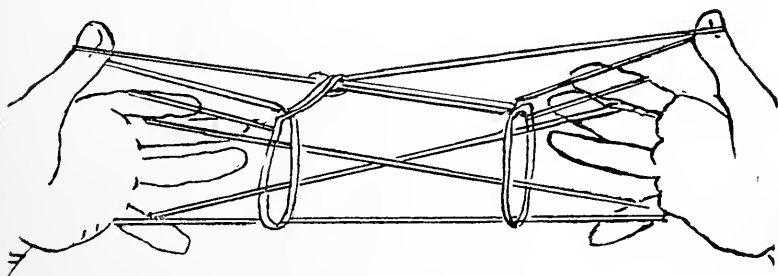


FIGURE 13—A SIBERIAN HOUSE.

It is made thus:—*First*, Take up the string in the form of Opening A. *Second*, Insert the four fingers of each hand from above into the corresponding thumb loops, and throw the near thumb string over the closed thumbs and fingers on to

the backs of the hands. *Third*, Bend each thumb from you over one string, under all the others, and with its back pick up the far string which comes round from the back of the hand. *Lastly*, Pull the dorsal string, which lies on the back of each hand, over the fingers on to the front of that hand, and extend. This is the *House*.

There are two boys inside the house. If you do not see them, release the index fingers, and draw the hands apart. The house will then break up, and the boys will be seen escaping, one from each side.

3. THE ELUSIVE LOOP. (Class B). This consists in making a loop, representing (say) a yam, to be offered to a hungry applicant. The operator causes the yam to disappear unless it is seized sufficiently promptly; hence a contest in rapidity between the operator and the applicant. Alternatively you can display the yam, and when the applicant asks for food make it disappear, remarking that you have none, or if you prefer, none for him. There are figures of this type common in all countries, and any of them will answer the purpose of the game.

One instance, from the Torres Straits, is given by Jayne, page 352. A simpler construction, common in Great Britain (and best illustrated with a loop of string some two to two-and-a-half feet long) is as follows:—*First*, Put the four fingers of the left hand, held vertically with its palm facing you, into the loop, giving a short straight piece of string across the palm of the hand and a loose loop at its back, and hook, from below, into this dorsal loop the right index-finger. *Second*, Bring the right index vertically over the left hand so as to make that string of the dorsal loop which is next the left index-finger pass between the left index and middle fingers and that string of the loop which is next the left little-finger pass between the left little and ring fingers, thus forming one loop on the left index and another on the left little-finger. *Third*, Move the right index so as to bring the two strings hooked on it (keeping the ulnar above the radial string) between the left index and thumb, and then round the thumb; next pass the left little-finger, from below, between these strings (the former radial string being ulnar to it), and then carry the right index-finger to the right as far as the string permits. *Fourth*, Turn the right index-finger towards you through two right angles, thus putting a twist on the loop held by it, and

then transfer this loop to the left index-finger, releasing the right index-finger. *Lastly*, with the right thumb and index-finger lift the two loops off the left thumb and put them, from the front, between the left middle and ring fingers. The loop thus placed on the back of the left hand is the Elusive Loop. On pulling the left palmar string this loop will disappear, and the string come free off the hand.

4. THE YAM THIEF. (Class B). This is a good illustration of a string story; one version of it is given in my Lecture, and a drawing of the final arrangement also appears there. In some places the figure is known as the *Mouse*. In Lifu it is called *Uprooting Alou*: Compton says that there the strings on the hand represent the root and the palmar string a shoot of the Alou. Someone, representing a strong stupid man, takes hold of the shoot, and though he pulls for all he is worth and is encouraged by the shouts of the onlookers, he cannot move the root: then someone else, representing the traditional diseased cunning degenerate takes hold of the shoot and (the thumb loop being released) the root comes up easily to the ostensible astonishment of the spectators. This design is widely distributed, and has been found in Africa, America, Oceania, Siberia, and Japan. (See Jayne, p. 340; Haddon, p. 80; Compton, *Journal of the Royal Anthropological Institute*, vol. 49, p. 233.)

The figure is made thus :—*First*, Hold the left hand open with the palm facing you, the thumb upright and the fingers pointing to the right and slightly upwards. With the right hand, loop the string over the left thumb, crossing the strings if you like, and let one string hang down over the palm and the other over the back of the hand—we may call these the palmar and the dorsal strings. *Second*, Pass the right index-finger from below under the palmar string, and then between the left thumb and index-finger, and with its front tip hook up a loop of the dorsal string; pull this loop between the left thumb and index-finger back on to the left palm; then with the right index-finger give the loop one twist clockwise, and put it over the palmar string on to the left index-finger; pull the two pendant strings so as to tighten the loops on the thumb and index-finger. *Third*, In the same way pass the right index-finger from below under the pendant palmar string, and then between the left index and middle fingers, and with its front

tip hook up another piece of the pendant dorsal string ; pull this loop back on to the left palm, and with the right index-finger give the loop one twist clockwise, and put it over the palmar string on the left mid-finger. *Fourth*, In the same way, working between the middle and ring fingers, hook up another loop of the pendant dorsal string, and put it on the left ring-finger. *Fifth*, In the same way, working between the ring and little-fingers, pick up another loop of the pendant dorsal string, and put it on left little-finger. *Sixth*, Take off the left thumb loop, and hold it between the left thumb and index-finger ; and, for the sake of effect, to show that the loops are still on the fingers, pull the pendant dorsal string. *Lastly*, Pull the pendant palmar string, and the figure will come off the hand.

5. THROWING A SPEAR. (Class B). This is a rather dull figure, but is easy to construct ; it has been found in Queensland, Africa, and the Torres Straits. In some places it is known as a *Canoe*.

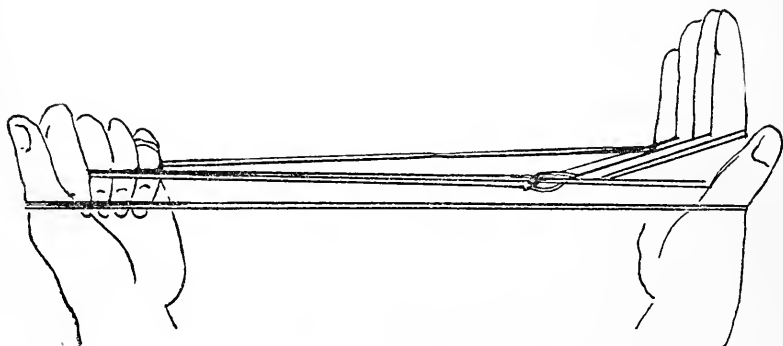


FIGURE 14—THROWING A SPEAR.

It is made thus :—*First*, Take up the string in the form of Opening A. *Second*, Transfer the right index loop to the tip of the left index, and pass the original left index string over this on to the right index. *Lastly*, Release the right index and extend, bringing the right thumb and little-finger close together. We thus get a spear with a heavy handle on the right hand, and three prongs resting on the left hand.

To throw the spear from one hand to the other pass the right index from below under the string just dropped from the right index, up to the left index, and with its back pick up this

string. Release the left index, and the spear flies to the other hand. This can be repeated over and over again. (See Jayne, p. 131; Haddon, p. 8.)

6. A MAN CLIMBING A TREE. (Class B). This is a figure derived from the Blacks in Queensland, and is one of the most effective examples of Class β . It is described and delineated in my Lecture. It is suggested that the two upright strings represent the trunk of a tree and the loops which move up these strings represent the arms and feet (or tree band and feet) of a man climbing up it. (See Lecture, p. 8; Haddon, p. 69.)

It is made thus:—*First*, Take up the string in the form of Opening A. *Second*, Bend each little-finger towards you over four strings, with its back pick up the next string, and return. *Third*, Navaho the little-finger loops. *Fourth*, Bend each index-finger over the palmar string between the two strings of the loop on the corresponding index-fingers, and press the tips of the fingers on the palms. *Fifth*, Holding the strings loosely, slip the loops off the thumbs; then still keeping the tips of the index-fingers on the palms, separate the hands, thus causing the loops near the bases of those fingers to slip over the knuckles and so off the fingers. *Lastly*, Put the far little-finger string under one foot, or under a heavy book, release the little-fingers, and pull steadily with the index-fingers, after hooking their tips into the string they hold.

7. A SALMON NET. (Class B). A *Salmon Net* or *Triple Diamonds* or *Caroline Diamonds* is a net-work of three meshes

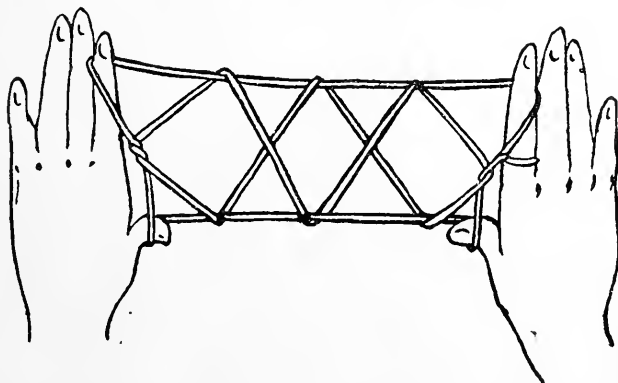


FIGURE 15—A SALMON NET.

placed side by side; it may be of negro origin, but comes to us from the Natiks in the Caroline Isles.

It is made thus :—*First*, Take up the string in the form of Opening A. *Second*, Take the right hand out of the string, and put the tips of the right thumb and little-finger together from the right side into the left index loop, extend, and release the left index. *Third*, With the back of the right index pick up the string on the palm of the left hand. *Fourth*, Bend each thumb from you over one string, and with its back pick up the next string. *Fifth*, Bend each index towards you, and with the extreme tip of its back pick up the next string. *Sixth*, Navaho the thumb loops. *Lastly*, Release the little-fingers, rotating the hands so as to face away from you, and extend ; beginners sometimes find this movement difficult. (See Jayne, p. 142.)

If an onlooker puts his hand, representing a salmon, in the middle mesh, it escapes if the left hand is released and the right hand pulled, but is caught if the right hand is released and the left hand pulled.

8. THE CATERPILLAR. (Class B). This figure is so popular with Cat's-Cradlers that I put it in my list of selected examples, though it is somewhat more difficult than the others. The design is known in North Australia, and various places in Southern Oceania ; it is described in Jayne under the name *One Chief*.

The Caterpillar is made thus :—*First*, Take up the string in the form of the first position, and then put a loop round the left thumb. *Second*, With the back of the right index pick up the left thumb loop ; pass the left index through the right index loop and, with its back, pick up the right palmar string ; pass the right index through the left index loop, and with its back, pick up the left palmar string. *Third*, Release the left hand ; hold the right hand horizontal and palm downwards, and put the loop which is nearer the tip of the right index over the loop which is nearer the base of that finger. *Fourth*, Put the left little-finger and thumb towards you between the two loops on the right index and resting on the joint of the finger ; and, with the back of the left little-finger, pick up the adjacent loop now nearer the base of the right index, and with the back of the left thumb, pick up the adjacent loop now nearer the tip of the right index ; extend, thus pulling both loops off the right index. *Fifth*, Transfer each thumb loop to the corresponding index-finger, and then transfer them back again by

putting the thumbs from outside into these loops. (The effect of this is to turn the thumb loops over.) *Sixth*, Bend each thumb from you over one string, and, with its back, pick up the next string. *Seventh*, Put each index-finger over the palmar string and over the far thumb string, and, with its back, pick up on the far tip of the finger the latter string, and hold it against the index-finger by the mid-finger. *Lastly*, Keeping

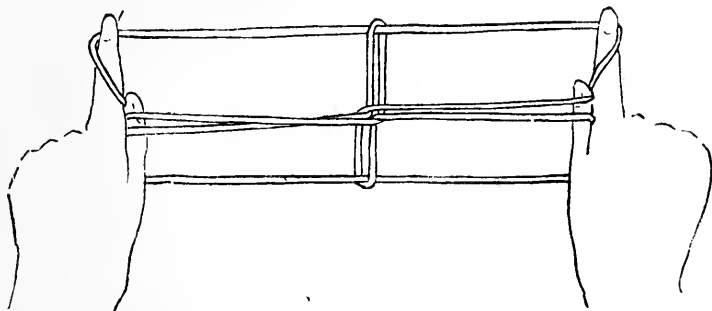


FIGURE 16—THE CATERPILLAR.

the thumbs and index-fingers close together, and the palms facing one another, bend down the little and ring fingers, and, with their tips, catch and stretch the far string, thus bringing it to the bottom of the figure; extend flat on the knee, and the caterpillar appears. The only difficult movement in this construction is the last one, it comes rather more easily if the string is not more than five feet long.

If the wrists are now turned so as to move the palms of the hands upwards, the caterpillar will contract. Then turn them back to their former position, and he elongates. Repeat the action, and he walks down the leg.

OTHER FIGURES IN CLASS B. Five other excellent examples of figures in Class β are the following:—*A Sea Snake*, from Murray Isle (see Jayne, p. 34; Haddon, p. 16). The Snake appears twisted round two parallel strings, and on slowly separating the hands he swims as the string unwinds. *A Well*, from Lifu Isle, Murray Isle, and Mabuiag (see Jayne, p. 85; Haddon, p. 17). The hollow in the middle of the figure represents the well; by slacking the little-finger strings and pulling the thumb and index strings we can make the water rise or fall in it; a further movement makes a fence round it. *The*

Ebbing Tide, from Lifu, Papua, and Queensland (see Appendix to my Lecture as printed in the *Proceedings of the Royal Institution*). The first movement gives horizontal lines representing the full tide, the next movement shows two rocks which appear as the tide ebbs, on repeating the movement another two rocks appear, and every further repetition shows two more rocks. The working can be reversed so that successive movements make the rocks disappear, two at a time, until the tide is again full. *The Head Hunters*, a good design, also from Murray Isle (see Jayne, p. 16; Haddon, p. 22). The final figure consists of two twisted loops which hang down and represent two warriors. On extending the hands the two men meet in the middle, and, on working the hands carefully, one loop breaks up, leaving only a kink representing the head of the defeated warrior. On continuing the extension, the victorious loop travels forward, pushing in front of it the head of the victim. These movements need care, but the result is effective. By making a knot in the string come into one of the twists we can make sure that that warrior shall be successful; and this knowledge may be useful, since usually, before the game begins, the tribes from which the warriors come are mentioned—slimness in such matters is not confined to white men. Lastly I may mention *Tallow Dips*, from Britain (see Jayne, p. 248; Haddon, p. 74). This story deals with the misadventures of a thief who stole a bunch of tallow dips, was arrested, and finally hanged.

Of other figures in this class I commend in particular an *Alaskan River* and the *Porker* as effective examples, but both involve much manipulation; their constructions are described in the Appendix to my Lecture as printed in the *Proceedings of the Royal Institution*; the *Porker* is a continuation of *Little Fishes*.

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